

The Categorical Instrumental Variable Model: Characterization, Partial Identification, and Statistical Inference

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Abstract

In this talk we analyze the categorical instrumental variable (IV) models with instrument, treatment, and outcome taking finitely many values. We derive a simple closed-form characterization of the set of joint distributions of potential outcomes that are compatible with a given observed data distribution in terms of a set of inequalities. These inequalities unify several different IV models defined by versions of the independence and exclusion restriction assumptions. They are also shown to be non-redundant. Lastly we consider statistical inference for a set of linear functionals of the joint counterfactual distribution, such as pairwise average treatment effects. Using a tail bound on the Kullback–Leibler divergence we construct a set of confidence intervals that will simultaneously contain both the upper and lower bounds for each estimand with probability at least $(1 - \alpha)$. We illustrate our method using data from the Minneapolis Domestic Violence Experiment.

This is joint work with Yilin Song (Columbia), Richard F. Guo (Michigan) and Gary Chan (University of Washington)